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(19) (CA) **CANADIAN PATENT** (12)

(54) Shaft Structure for Sports Equipment

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ABSTRACT

This invention relates to a shaft structure for use in an ice hockey stick or a similar item of sport equipment. The shaft comprises a low-density core surrounded by a pair of light wood laminates and a pair of fiber reinforced plastic laminates. The resulting structure is then surrounded by a glass fiber reinforced plastic wrapping.

SHAFT STRUCTURE FOR SPORTS EQUIPMENT

BACKGROUND OF THE INVENTION

The present invention relates to a shaft structure for use in an ice hockey stick or any other item of sport equipment requiring characteristics similar to those of an ice hockey stick. Some of these characteristics are lightness, balance, stiffness and high resistance to breakage.

Traditionally, ice hockey sticks have been constructed of white ash. This wood is resistant to impact breakage and is quite flexible and light. However, the amount of high quality hardwood suitable for producing hockey sticks has become more and more limited and has considerably increased the cost of production of ice hockey sticks. Moreover, the conventional wood hockey stick has an obvious disadvantage in that the wood has a tendency to crack under impact loads imposed upon the wood during usage and therefore a wood ice hockey stick has a short life span.

In more recent years, there have been proposed and patented different alternatives to the traditional ice hockey stick blade and shaft structures. Various attempts have been made up to now to replace wood by another material such as aluminum, glass fiber reinforced plastic, wood laminates or certain combinations of these materials.

For example, blade structures have been considerably improved by the use of various plastics and glass fiber reinforced plastics.

Also, various attempts have been made to improve the lightness, stiffness and breakage characteristics of ice hockey stick shaft structures. A number of these attempts involve the use of composite, laminated or partially hollow shaft structures. See, for example:

Canadian Patent 1,043,065 (Goupil et al)
Canadian Patent 1,072,142 (Diedreich)
Canadian Patent 1,099,761 (Burns)
Canadian Patent 1,145,371 (Buchanan et al)
Canadian Patent 1,147,767 (Ardell et al)
Canadian Patent 1,151,693 (Goupil et al)
U.S. Patent 2,730,367 (Bublik)

However, these attempts have always resulted in a shaft having certain improved characteristics but at the expense of other important characteristics.

GENERAL DESCRIPTION OF THE INVENTION

It is a general object of the invention to provide an improved shaft structure for use in an ice hockey stick or a similar item of sports equipment, presenting improved characteristics required by advanced and professional hockey players.

It is a more specific object of the invention to provide a light weight hockey stick shaft while maintaining high strenght and stiffness characteristics.

It is also an object of this invention to provide a light weight hockey stick shaft which can be easily balanced to meet the users' requirements.

The stick shaft structure, according to the invention, comprises a low-density core. A light wood laminate is attached to two opposing sides of the core while a fiber reinforced plastic laminate is attached to the remaining periphery of the core. The resulting structure is then wrapped with glass fiber reinforced plastic.

GENERAL DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the invention will be better understood in the light of the following detailed description of the preferred embodiments which are illustrated, by way of example only, in the accompanying drawings, wherein:

Figure 1 is a perspective sectional view of the free end of an ice hockey stick shaft embodying the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

Attention is first directed to Figure 1, in which the shaft structure of stick 10 for use in ice hockey or an equivalent game is seen to include four components: a low-density core 20; side walls 30 and 31 made of a fiber reinforced plastic laminate; side walls 40 and 41 made of a light wood laminate and glass fiber reinforced plastic wrapping 50.

It will be noted that the laminates 30, 31, 40 and 41 together with wrapping 50 form a torsion box 60 while the core 20 gives the initial dimensional stability and prevents the torsion box 60 from collapsing.

The core 20 may be made of a polyurethane foam. The use of such a polyurethane foam makes the hockey stick exceptionally light, such foam having a density of from 10% to 20% of that of the wood normally used in the manufacture of ice hockey stick shafts. Moreover, the mechanical properties of the foam, particularly in its inner friction, will result in high dampening of the vibration that occurs on impact as the blade hits the puck during a slap shot.

Furthermore, a portion of the foam can easily be removed from the end of the ice hockey stick shaft and replaced with a heavier material (for example, lead, steel, etc.) thus allowing the stick to be effectively re-balanced if required by the user.

The fiber reinforced plastic laminate acts as the main carrier of the loads applied on the stick shaft and its mechanical properties govern the rigidity or stiffness of the shaft when a puck is shot. This rigidity or stiffness can be varied by changing the dimensions of laminates 30 and 31 or by using or adding different fiber materials such as glass fibers, carbon fibers, aramid fibers, etc. This provides the possibility of producing custom tailored or tuned ice hockey sticks not only in form but also in "behavior".

For example carbon fiber composites have a high strenght-to-weight ratio, a high stiffness-to-weight ratio (60% of the stiffness of steel at 20% its weight), high creep resistance, and good fatigue resistance. Aramid fibers (available under the trade mark KEVLAR) have a high weight-to-stiffness ratio, very good resistance to stretch and excellent vibration-dampening characteristics. Their slash and cut resistance are also considerably higher than those of glass or carbon fibers. The use of aramid fiber composites can produce weight savings of up to 40% when compared to glass and increased stiffness. Hybrid composites made of two or more of carbon fibers, aramid fibers and glass fibers can also be used.

The light wood laminates 40 and 41 give the stick its lateral stiffness thus reducing considerably the warping of the stick when shooting a puck. This results in much improved accuracy when shooting a puck. The dimensions and type of material used for laminates 40 and 41 play an important role in the re-action and "feel" of an ice hockey stick. Airplane veneer is appropriate for this use.

The glass fiber reinforced plastic wrapping 50 is bounded to the exterior of laminates 30, 31, 40 and 41 and ensures tight connection of these components which results in the inter-action of all the parts which give the stick its unique properties. The wrapping 50 also adds to the torque resistance of the shaft.

EXAMPLE

For example, a rectangular core of 22 mm by 17 mm having the appropriate lenght is made of a polyurethane foam having a density of 200 g/liter.

An airplane veneer lamitate having a thickness of 4 mm, a width of 17 mm and the desired lenght is glued unto the each 17 mm side of the foam core.

Subsequently a laminate made of glass fibers imbedded in an epoxy resin having a thikness of 1.2 mm, a width of 30 mm and the desired lenght is glued unto each 30 mm side of the foam/wood assembly. It should be noted that the glass fibers drawings should extend longitudinally. For increased striffness, 10 drawings of carbon fibers can be distributed in each such laminate.

The four edges of the resulting shaft structure a then rounded by sanding or other known method to provide the desired grip.

Finally, the shaft structure is introduced into a woven tube made from glass fibers which tube is then encased or imbedded in an appropriate plastic such as an epoxy resin.

Although the invention has been described in association with a shaft having a rectangular cross-section, the invention is also useful in shafts having square, oval or round cross-sections, although better results are obtained if a generally rectangular configuration is chosen. Similarly the invention has been described by the use of certain proportions and materials. It is important to note that these can be changed without departing from the present invention. However, any such changes will modify the overall properties of the shaft and will allow the construction of ice hockey sticks according to the varied requirements of ice hockey players.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1) A shaft structure for use in an ice hockey stick or a similar item of sports equipment comprising a low-density core surrounded by a laminate of stiff material, the resulting structure being wrapped with a glass fiber reinforced plastic.

2) A shaft structure as claimed in claim 1, wherein the core is made of a low-density foam.

3) A shaft structure as claimed in claim 1 or claim 2, wherein the core is made of a low-density polyurethane foam.

4) A shaft structure as claimed in claim 1 wherein the cross-sectional shape of the shaft structure is generally rectangular.

5) A shaft structure as claimed in claims 1, 2 or 4, wherein at least two diametrically opposed sections of the laminate are formed by a light wood laminate;

6) A shaft structure as claimed in claims 1, 2 or 4, wherein two diametrically opposed sections of the laminate are formed of a light wood

laminate and the remaining portions of the laminate are formed by a glass fiber reinforced plastic laminate.

7) A shaft structure as claimed in claims 1, 2 or 4, wherein at least two diametrically opposed sections of the laminate are formed by a airplane veneer laminate.

8) A shaft structure as claimed in claims 1, 2 or 4, wherein two diametrically opposed sections of the laminate are formed of a light wood laminate and the remaining sections of the laminate are formed by a carbon and glass fiber reinforced plastic laminate.

9) A shaft structure as claimed in claims 1, 2 or 4, wherein two diametrically opposed sections of the laminate are formed by a light wood laminate and the remaining sections of the laminate are formed by an aramid and glass fiber reinforced plastic laminate.

10) A shaft structure as claimed in claims 1, 2 or 4, wherein two diametrically opposed sections of the laminate are formed by a light wood laminate and the remaining sections of the laminate are formed by a carbon and aramid fiber reinforced plastic laminate.

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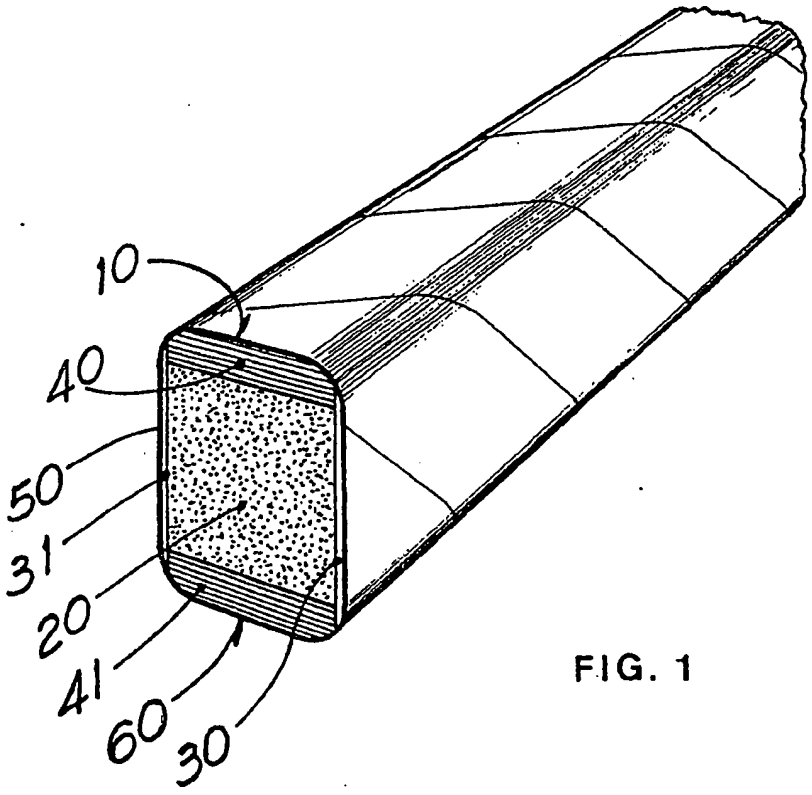

FIG. 1

ARI JORMAKKA

per: Lapointe Rosenstein

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his patent agents